REMARKS

This amendment is submitted in response to the Office Action mailed July 31,2001. Claims 1thorugh 34 are pending in the subject patent application. Claims 1-4, 6-17 and 22-34 were rejected by the Examiner in view of multiple references cited. Claims 5, and 18-21 were objected to as being dependent upon a rejected claim. Figures 1,2,3, and 5 were objected to due to the absence of legends for the structural elements. Claim 14 was objected to due to informality.

The amendments have been made to the drawings to insert legends for the elements shown in Figures 1,2,3, and 5, and to claim 14 to correct informality. Prior art was studied by the Applicants and the claim rejections were traversed based on the scope and content of the cited references. For the following reasons, reconsideration and allowance of the subject patent application are respectfully requested.

The Examiner objected to drawings. The Applicants provided the legends requested by the Examiner. The Applicants intend to submit the corrected formal drawings after Examiner's approval of inserted legends shown in figures 1,2,3, and 5 in red ink. It is believed that the amended drawings overcome the Examiner's objection.

The Examiner objected to claim 14 because of the informality in line 10 of the claim. The Applicants corrected claim 14 according to the Examiner's observation.

The Examiner rejected claims 4,6-7, 15, 17 and 28 under 35 U.S.C. §112, second paragraph as indefinite. The Examiner asserting that the clause "a spectral spacing between said spectral lines exceeding an electrical detection bandwidth of transmitted CDM optical signals" is unclear. The Examiner is invited to consider, for example the disclosure in page 9, lines 29 -32, and page 10, lines 1-4 of the specification of the subject patent application clearly describing the limitation relating to the broadband source. The broadband optical source, according to one of the embodiments is implemented as series of several discrete lasing modes separated by spectral gaps or spectral spacing determined by transmitted data rate. Both terms,

"spectral gap" and "spectral spacing", are well known terms in the art. To reduce RIN as requested by the subject invention, the spectral spacing between spectral line must exceed an electrical detection bandwidth. "Electrical detection bandwidth" is a conventional term that corresponds to the frequency bandwidth of the receiver. The terminology used for characteristic of the broadband source in claims 4 and 15, and being dependent on them respective claims 6-7, and 17, would regard by one of ordinary skill in the art as self-sufficient for understanding a claimed matter. Claim 28, remarked by the Examiner as unclear one, includes the limitation that the spectral spacing between the spectral lines defining a maximum number of CDM transmission channels. The relevant disclosure for this limitation can be found in page 7,the second paragraph. A broadband optical source generates light in a range of wavelengths designated for **m** CDM transmission channels.

The Examiner rejected Claims 1,22, and 32-34 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* (U.S. Patent No. 5,144,467). The Applicants respectfully disagree with this rejection for the following reasons.

The Examiner states that Kitajima *et al.* discloses a multichannel optical communication system for transmitting optical signals via an optical fiber and referring to col.1, lines 1-12 and fig.1 of the patent. Such broad definition of the field of the invention made by the Examiner includes the actual field of the invention stated in the Kitajima *et al.* patent that is recited as follows:

" The present invention generally relates to optical fiber communications, and, more particularly, to a heterodyne or homodyne detection/reception system which is suitable for selective reception of FDM (frequency division multiplex) signals. "

Kitajima *et al.* invention, according to their own definition supported by the specification and drawings, refers to a coherent optical frequency division multiplex communication system (and more particularly, to an improvement in coherent detection scheme) that provides fundamentally different way of transmitting the optical signals via an optical fiber compared to the multichannel communication system of the present invention that utilizes wavelength and coherence division multiplexing.

The coherent optical frequency division multiplex communication system transmits

information by modulating the frequency or phase of the optical carrier and detects the transmittal signal by using homodyne or heterodyne detection techniques. Since frequency coherence of the optical carrier plays an important role in the optical carrier of such systems, they are referred to as coherent communication techniques. The basic idea of functionality of the systems utilizing these techniques is to mix the received signal coherently with another optical wave before it is incident on the photodetector. The optical wave is generated locally at the receiver by using a narrow –linewidth laser, called a local oscillator (this term is borrowed form the radio communication terminology). The received signal is mixed with the local oscillator output. When the carrier frequency of the received signal is not equal to the local oscillator frequency, the optical signal is demodulated in two stages; its carrier frequency is first converted to an intermediate frequency before the signal is demodulated to the baseband. It is not always necessary to use an intermediate frequency. Depending on whether or not the intermediate frequency equals zero, there are homodyne and heterodyne detection techniques to use.

In case of hererodyne detection the local-oscillator frequency is chosen different from the signal-carrier frequency such that the intermediate frequency is in the microwave region. Kitajima *et al.* improve heterodyne detection technique (see, for example, col.8, lines 21-25) by providing an optical tuning of optical frequencies of the transmission signals for the optical frequency division multiplex transmission system. None of the objectives or technical solutions of Kitajima *et al.* invention relates to the present invention.

The present invention relates to WDM communication system that is capable of transmitting several coherence division multiplexed optical signals via one wavelength division multiplexed transmission channel. Each WDM transmission channel transmits a WDM optical signal on a unique wavelength within a designated bandwidth while a plurality of CDM optical signals share the designated bandwidth of at least one WDM transmission channel for the substantial extension of the network capacity.

The Kitajima *et al.* teaching cannot even contemplate such objective due to the different field of application, architectural structure of the system and optical components used for its implementation. The Examiner reads a nonexistent technical description into the Kitajima *et al.* reference. For example, the Examiner identifies optical transmitter 104 of Kitajima as a CDM

transmission unit of the present invention. Kitajima *et al.* patent disclosure comprises four references to the element 104 cited in a clause "four optical transmitters 101 to 104" (col.4, lines 50 and 59; col. 10 lines 40 and 49). There is no differentiation in the disclosure between optical transmitter 101, 102, 103 or 104. To support the statement that CDM transmission unit of the present invention corresponds to the optical transmitter104 the Examiner refers to col.1, lines 13-15 of specification ("A coherent optical frequency division multiplex communication system".) The Examiner's statement makes Applicants to believe that the Examiner erroneously equates CFDM and CDM techniques.

Both CFDM and CDM techniques have been developed out of microwave or radio technology and represent different ways of transmitting multichannel signals via an optical fiber. CFDM was originated from coherent heterodyne detection technique of mixing the received signal coherently with additional optical wave before detection and utilizing a narrow line-width laser. CDM was originated from CDMA technique with randomly modulated microwave source acting as a broadband source shared by many transmission channels. CDM transmission unit of the present invention provides, within each CDM transmission channel, a phase modulated light beam delayed by several coherence times relative to the reference path, and utilizes a broadband source.

To provide *a prima facie* case of obviousness of the claims 1, 22, 32-34, the Examiner relies on the Kitajima *et al.* patent and the knowledge of artisan at the time of invention. The Applicants respectfully submit that any person of ordinary skill in the art would never even consider incorporation of CDM transmission unit into CFDM system.

The Examiner rejected Claims 2,4,6-7 and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Brown *et al.* (US patent No.5, 663,639). The Applicants respectfully disagree with this rejection for the following reasons.

Brown *et al.* invention relates to the CFDM systems that cannot use the broadband source by the origin of their operation that were discussed in connection with the Kitajima *et al.* patent. The specification of Brown comprises reference to a signal source or tunable sweep oscillator using photomixer. The radiation source of Brown *et al.* can operate in a high power narrow-band mode (a signal source) when a constant frequency output is provided or in a low-power broadband mode in

which the frequency is tunable (sweep oscillator). (Underlines by the Applicants). In operation the oscillator provides one constant frequency for each transmission channel. The broadband optical source provides multiple frequencies for each transmission channel. The Examiner mistakenly recognized the broadband source of the present invention in a tunable oscillator. The statement that Brown et al. utilize a broadband optical source is improper.

The Examiner rejected Claims 23, 27-28 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Burns *et al.* (US patent No.5, 917,970). The Applicants respectfully disagree with this rejection.

The Burns *et al.* patent discloses a plurality of narrow-band optical sources. In the specification, they described as "N channel highly coherent, solid state, narrow-band, laser array 12 providing N separate optical output wavelength, one for each desired channel", (col.2, lines 17-19)(Underlined by the Applicants). The scope of Burns *et al* reference separately or in combination with the primary reference is irrelevant to the subject invention.

The Examiner rejected Claims 3 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Brown *et al.* and further view of Takara, H., Kawanishi *et al.* The Applicants respectfully disagree with this rejection.

The irrelevancy of primary and secondary references of this rejection was discussed earlier. The Applicants respectfully submit that this rejection is improper not only because of the primary and secondary references. The Examiner segregates two elements, optical filter and erbium-doped fiber amplifier from the Takara, H., Kawanishi *et al.* scheme, and corresponds them to the limitations of claim3. The Examiner ignores that claim 3 along with "at least one erbium-doped fiber amplifier" cites "a semiconductor optical amplifier (SOA)" that is utilized in the broadband optical source of the present invention. More over, the erbium-doped fiber amplifier (EDFA) of the Takara, H., Kawanishi *et al.* is used in the optical waveform measurement scheme with improved time resolution. The disclosure of the waveform measurement scheme does not suggest, mention or contemplate a semiconductor optical amplifier. This scheme does not relate to the relative intensity noise reduction of the broadband source, as well as to high speed data transmission via multichannel WDM system with CDM transmission unite that is incorporated into at least one individual WDM transmission channel.

The Examiner rejected Claims 8-11 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Brown *et al.* and further in view of Burns *et al.* The Applicants respectfully disagree with this rejection since none of these references is in the scope and content of the subject invention according to the discussion presented above.

The Examiner rejected Claims 12-13 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Brown *et al.* and in further view of Watanabe (U.S. patent No.5,896,211). The Applicants respectfully disagree with this rejection. The primary and secondary references related to CFDM techniques are improperly cited for the reasons already disclosed above.

Watanabe invention relates to yet another type of optical communication system. Watanabe patent discloses sub-carrier multiplexed optical communication system that comprises only one narrow-band source, which is sub-modulated by plurality of microwave frequencies, each microwave frequency is used to transmit one communication channel. Watanabe reference is irrelevant to primary and secondary references as well as to the present invention.

The Examiner rejects claims 14-15 and 17 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Burns *et al.* and in further view of Singh *et al.* (US patent No. 6,185,345). The Applicants respectfully disagree with this rejection.

Rejecting these claims the Examiner combines teaching of Kitajima and Burns that are not applicable to the present invention as disclosed above, adding to them Singh patent and interconnecting them between each other by knowledge of a person of ordinary skill in the art. The Applicants disbelieve that this hypothetical ordinary skilled person would discover a similarity in intended use of unbalanced Mach-Zehnder interferometers of Singh *et al.*, that are utilized as a spectral separating element for outputs of a plurality of narrow-band optical sources, and the claimed device separating optical channels by their coherence properties together with broadband sources. Concerning the temperature stabilization of unbalanced Mach-Zehnder interferometers, this is a requirement that is equally applicable to the Mach-Zehnder interferometers of Singh et al and the present invention.

The Examiner rejected claims 9-11, and 16 under 35 U.S.C. § 103(a) as being unpatentable over Kitajima *et al.* in view of Brown *et al.*, Burns *et al.* and in further view of Singh *et al.* and Takara, H. Kawanishi *et al.* The Applicant respectively disagree with this rejection since none of these references directly or inherently teach the subject matter of the present invention as it was discussed above.

Rejecting the claims of the present patent application the Examiner relies upon prior art references and their combination that "would have been obvious to an artisan of ordinary skill". It means that prior art is viewed through the eyes of the person of ordinary skill in the art. The Applicant is seriously concerned regarding the statements made by the Examiner on behalf of such a skilled person, as well as the hindsight reconstruction to pick and choose among isolated disclosures in the prior art to establish obviousness.

The Kitajima CFDM system with CDM transmission unit of the present invention equipped with Brown et al low-power broadband mode tunable oscillator or Burns et al narrow-band laser array will not reconstruct the multichannel optical communication system of the present invention The teachings of Watanabe, Singh or Kawanishi will not assist in this process either. The Applicants respectfully submit that none of the cited references taken separately or together disclose or suggest the present invention as claimed.

The Applicants acknowledge that the Examiner found claims 5,18-21 allowable. The Applicants believe that the base claims upon which these claim being dependent will be reconsidered and allowed by the Examiner.

Attached hereto is a marked-up version of the changes made to the claim 14 by the current amendment. The attached page is captioned **"Version with marking to show changes made."**

CONCLUSION

In view of the foregoing amendments and remarks, it is believed the application is in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Respectfully submitted,

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Version with marking to show changes made

14. (Amended) A multichannel optical fiber communication system for transmitting CDM optical signals via at least one WDM transmission channel comprising:

a first plurality of individual WDM transmission channels for transmitting WDM optical signals and at least one individual WDM transmission channel for transmitting said CDM optical signals,

each individual WDM transmission channel of said plurality comprising a single frequency optical source for generating light within said each WDM transmission channel for transmitting an optical signal on a unique wavelength within a designated range of wavelengths; and

at least one coherence division multiplexed (CDM) transmission unit disposed within said at least one individual WDM transmission channel, said at least one CDM unit comprising:

a second plurality of CDM transmission channels,

a broadband optical source for generating light within said at least one WDM transmission channel for **[for]** transmitting said CDM optical signals via said second plurality of CDM transmission channels,

a light splitter for dividing said light generated by said broadband optical source into one reference path and a number of optical paths equal to a number of CDM transmission channels,

each said CDM transmission channel comprising a phase modulator and an optical delay line interconnected therebetween, said optical delay line comprising a temperature sensitive component for stabilization of phase drift caused by environmental fluctuations.